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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 40

Application Number: 09/259,145
Filing Date: February 26, 1999
Appellant(s): PAN ET AL.

Joseph A. Walkowski
Registration No. 28,765
For Appellant

EXAMINER'S ANSWER

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This is in response to the appeal brief filed December 17, 2002.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

Appellant's brief includes a statement that claims 25, 26, 31-34, 37, 38 and 46-49, Group 1, and claims 39, 40, 43-45, Group 2 do not stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

5,545,577	Tada	8-1996
5,874,325	Koike	2-1999
5,846,596	Shim et al.	12-1998.
5,837,378	Mathews et al.	11-1998
JP-05-109736	Murakami	4-1993
JP-61-159741	Noda et al.	7-1986

Wolf et al. "Silicon Processing for the VLSI Era", Lattice Press, Vol. 1, 1986, pp. 262-265

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims **25**, 26, 31, **33**, 34, 37-40 and 43-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tada (U.S. Patent No. 5,545,577) in view of Koike (5,874,325) and S. Wolf et al., *Silicon Processing for the VLSI Era*, Vol. 1, page 264.

With respect to claims **25**, **33**, **39** and **46**, Tada teaches an intermediate structure in the formation of an isolation structure for a semiconductor device substantially as claimed including:

a semiconductor substrate (100) having at least a portion free of field oxide structures and having a first surface and a second surface, the first surface opposing the second surface;

at least one p-well (3) and at least one n-well (2) on the substrate first surface;

at least one activated, annealed p-type area (5) within the at least one n-well (2);

at least one activated, annealed n-type area (6) within the at least one p-well (3); and

a substantially dopant-free, uninterrupted diffusion barrier layer (silicon nitride mask) over the substrate first surface. (See Fig. 2c and 3a, col. 6, ll. 3-32).

Thus, Tada is shown to teach all of the features of the claim with the exception of the limitation relating to substantially dopant-free barrier layer (silicon nitride mask) encapsulating the semiconductor substrate.

However, Koike teaches, i.e. on the top surface and the bottom surface of the substrate (see Fig. 11), a substantially dopant-free barrier layer (104) formed on the first surface, and during the formation of the silicon nitride film 104 on the top surface the same material, silicon nitride, unavoidably forms on the opposite surface. (See col. 6, line 61 to col. 7, line 2).

Therefore, in view of this teaching of Koike, the silicon nitride material formed in Tada, col. 6, lines 30-31, will also form on the bottom surface of the substrate.

Further, intermediate semiconductor substrate of Tada appears to have at least a portion free of field oxide structures. (See Fig. 2c). Field oxides are structures 9 in Fig. 3a of Tada, which structures are absent in Fig. 2c.

Note that, the p-type area (5) and n-type area (6) of Tada ***are formed*** in the wells (2,3), thus, the "activated" limitation of claim 1 is met. Moreover, to activate the dopants, the

substrate must be annealed. (See S. Wolf et al., *Silicon Processing for the VLSI Era*, Vol. 1, page 264).

With respect to claims 26, 34, 40 and 47, the structure of Tada also includes an oxide layer (4) between the substrate first surface and the substantially dopant-free barrier layer.

With respect to claims 31, 37, 43 and 48, the masking layer of Tada is silicon nitride formed after the activation of the dopants and there is no indication in the reference that it contains any dopant, therefore, the silicon nitride layer is seem to be dopant free.

With respect to claim 38, the at least one activated, annealed doped area of Tada comprises an impurity selected form the group consisting of a n-type impurity and a p-type impurity.

With respect to claim 44, the at least one activated, annealed first doped area of Tada comprises a p-type impurity (2) and the at least one activated, annealed second, differently doped area comprises an n-type impurity.

With respect to claim 45, the at least one activated, annealed first doped area of Tada comprises an n-type impurity (2) and the at least one activated, annealed second, differently doped area comprises a p-type impurity.

2. Claims 32 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tada '577 and Koike '325 as applied to claims 25 and 46 above, and further in view of Shim et al. (U.S. Patent No. 5,846,596).

Tada and Koike teach all of the features of the claim with the exception of using silicon oxynitride for the substantially dopant-free barrier layer.

However, Shim teaches silicon oxynitride and silicon nitride materials can be used for the oxidation resistant layer (130). (See col. 3, ll.18-20).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to substitute the silicon nitride layer of Tada with silicon oxynitride as taught by Shim since both materials function as oxidation resistant layer.

(11) Response to Argument

(A) *Rejection Under 35 USC § 103*

(1) Claims 25, 26, 31, 33, 34,37-40 and 43-48

With respect to claims 25, 33 and 46, Appellant appears to contend that Tada does not teach a barrier layer. The claimed barrier layer, as disclosed, is a silicon nitride oxidation resistant layer 120. (Fig. 3). Appellant cites (page 6): "Subsequently, a *silicon nitride is used to form a field oxide film*. Column. 6, line 27-31". The appellant seems to recognize the existent of the silicon nitride mask layer in Tada. This silicon nitride layer of Tada is similar to the silicon nitride barrier layer 120 of the present invention, used as a mask to form field oxide film 130 as shown in Fig. 7 in the present application.

With respect to the term "uninterrupted and dopant free", as is the case in all intermediate structures in this art, prior to patterning to form an opening, the silicon nitride layer of Tada would be uninterrupted and dopant free because the doping have already been performed. (See Fig. 2c). Koike shows in Fig. 11, the "uninterrupted" masking layer 104.

Reviewing the disclosure and drawings (Figs. 2c and 3a), one having ordinary skill in the art would have concluded that, subsequent to the process step illustrated in Fig. 2c, a silicon

nitride mask has been formed over the base oxide film 4, the silicon nitride mask has been patterned to form openings, an oxidation has been performed to form field oxide 9. (Fig. 3a). These process steps are well known in the art as shown in all references and are similar to Figs. 4-7 of the present invention.

Koike is cited to show that a silicon nitride oxidation mask layer is formed by a well known deposition process in the art, chemical vapor deposition (CVD). Koike teaches "the silicon nitride film 104 are formed generally by a reduced pressure CVD method, and are unavoidably formed on the reverse side because the vapor deposition coats all exposed surfaces.

With respect to the motivation to combine, Appellant argues: "While the nature of the problem to be solved is a potential source of a motivation to combine, the cited references and the claimed invention in the present case do not address the same, or even similar, problems".

In response to Appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the general knowledge in the art is, under oxidation, all exposed areas of a semiconductor substrate will be oxidized, therefore, the reverse surface of Tada, if exposed should be oxidized, as well. However, in view of Koike, by forming the silicon nitride on the reverse surface, oxidation of the back side is prevented.

Koike is merely a teaching reference to show that during chemical vapor deposition, the deposited material coats all exposed surfaces. Therefore, during deposition of the silicon nitride layer as a mask in Tada (col. 6, lines 30-31), the same material, silicon nitride, will also deposit on the bottom surface.

Further, in response to Appellant's argument that *the cited references and the claimed invention in the present case do not address the same, or even similar, problems*, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

The combination of the references, Tada and Koike, clearly renders claims 25, 33 and 46 obvious as well as the dependent claims 26, 31, 34, 37, 38, 47 and 48.

With respect to claim 39, Appellant argues: "Tada does not teach or suggest a substantially dopant-free, uninterrupted barrier layer". As addressed above, coating cover the entire surface prior to patterning of the coated layer, as seen in Fig. 11 of Koike.

Appellant further argues: "Tada also *does not teach or suggest* that the semiconductor substrate has at least one activated, annealed first doped area on its first surface and at least one activated, annealed second, differently doped area within the first doped area".

All of these elements are in Tada, as discussed in the rejection above, including:

at least one p-well (3) and at least one n-well (2) on the substrate first surface;

at least one activated, annealed p-type area (5) within the at least one n-well (2);

at least one activated, annealed n-type area (6) within the at least one p-well (3).

Appellant also argues: "Koike *does not suggest* the desirability of, or provide an objective reason for, forming a silicon nitride layer on both surfaces of other semiconductor substrate".

Actually, Koike does teach forming a silicon nitride layer on both surfaces. (See Fig. 11).

Appellant further argues: "the structure of **Koike** does not have at least one activated, annealed first doped area on it first surface and at least one activated, annealed second, differently doped area within the first doped area while the substrate is encapsulated by the silicon nitride films, as recited in claim 39".

As clearly pointed out in the rejection, all of these limitations, with the exception of encapsulation, are taught by Tada. The argument seems to compartmentalize the references, the rejection is based on the combination of the references.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Similarly, the combination of Tada and Koike clearly renders claim 39 obvious as well as dependent claims 40 and 43-45.

(2) <u>Claims 32 and 49</u>

Shim teaches that silicon nitride and silicon oxynitride are well known in the art as an oxidation mask materials. It would have been obvious to substitute one well known material, i.e. silicon nitride, with another well known material for the same purpose, i.e. silicon oxynitride.

Appellant argues: "Shim does not disclose that the silicon nitride or silicon oxynitride layer is applied to both surface of the substrate".

Once again, the encapsulation is taught by Koike. The Appellant appears to argue the references individually.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

According to Shim, the use of silicon nitride or silicon oxynitride for the oxidation mask is merely a matter of preference.

The combination of Tada, Koike and Shim clearly renders claims 32 and 49 obvious.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

A.M
March 19, 2003

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